Description

Error handling of user information received via a communications network

The invention relates to a method and a device for error correction of user information received via a communications network.

Document D1 (US 5699405) describes how data and voice signals of a communications information signal of a cellular radio telephone are decoded simultaneously by two decoders. A data signal of the information signal is decoded by a data decoder, and then a data signal sensor decides whether the decoded signal is a normal data signal. Only a normal signal is forwarded to a signal converter for executing a code conversion. The resultant signal is output by a transmitter circuit. A voice signal of the information signal is decoded by a voice decoder, and then a voice signal sensor decides whether the decoded signal is a normal voice signal. Only a normal signal is sent to a digital/analog converter for transforming into an analog voice signal. The validity of the decoded signals is verified, for example, by varying the frequency band and/or the amplitude of the decoded signals. Owing to the simultaneous decoder operations, the data and the voice signals are decoded efficiently at high speed by one modem card. Hence there is one modem card for a cellular radio telephone for simultaneous transmission of data signals and voice signals to an information terminal, where an information terminal may here be a computer (column 1, line 63).

In cellular text telephony, a cascade of a cellular radio receiver (e.g. GSM modem) and a CTM receiver (Cellular Text telephone Modem) is provided for received texts. A real example is the US American text telephony standard (see 3GPP TS 26.226) in which text is first converted into audio signals by digital coding of an alphabet, channel coding and frequency modulation, and then the audio signals are processed further in the same way as normal speech by cellular radio terminals (cellular radio modems) and transmitted via a cellular radio channel. In order to guarantee the reliable transmission of emergency calls, maximum error rates are specified for the transmission of the individual letters (see 3GPP TS 26.231). A CTM receiver and a cellular radio receiver are not highly compatible, however, and the complete system (cellular radio + CTM) cannot achieve a sufficiently good performance, in particular in the sense of the transmission efficiency, for the following reasons:

- A cellular radio voice coder/decoder (such as the AMR) in cellular radio is optimized for coding/decoding of human speech. For the artificially generated (CTM) audio signals, the voice coder/decoder is not efficient.

The additional information that the CTM receiver receives can be used selectively to compensate for the disadvantages described for the transmission of data containing user information via voice coders. According to the invention, the voice decoder can suppress error-concealment mechanisms when the information is present that data containing user information is being transmitted. The transmission efficiency is thereby increased significantly, and the stipulated maximum error rates can be met, which, for instance, is a precondition for the sale of cellular radio equipment in the USA.

Developments of the invention are cited in the sub-claims.

The invention is described in more detail with reference to an exemplary embodiment shown in the figure, where

Figure 1 shows a simplified representation of the suppression of the error concealment in the voice decoding and error correction with the aid of the additional information relating to the data to be transmitted.

Figure 1 shows how the AMR channel decoder (1) receives the transmitted data from the equalizer in the form of TDMA bursts, and corrects channel errors as far as possible. It (1) identifies from a checksum (CRC) whether the channel-decoded AMR voice frame is usable or unusable (in the sense of containing too many errors as a result of the transmission).

It passes to the AMR voice decoder (2) the decoded voice frame, the AMR mode and the additional information as to whether the frame is usable. The latter piece of information is contained in the RX_FRAME_TYPE parameter (BFI = Bad Frame Indicator). The AMR voice decoder (2) uses the BFI in order not to convert unusable frames into voice (audio signal) but in this case to synthesize the audio signal from frames from the past in such a way that the human ear only perceives a minimum interference (error concealment). This mechanism can be disabled if it is signaled via the CTM text/voice

indicator, that data (CTM signal) containing user information is being transmitted. At the output of the module is a PCM signal (Pulse Code Modulation). The BFI can be transmitted in unused bits (LSB) of the PCM signal. The advantage here is that one can implement the exchange of the additional information using the existing hardware.

The CTM receiver (6) comprises, amongst other components, a demodulator unit (3) and an error correction module (4). In the former, two bits are generated from 40 PCM signal values, said bits being included in frequency modulated form in the PCM signal. The bits contain reliability information ("soft values") that indicates the likelihood of the decoded data matching the originally transmitted data. The reliability information is erroneously high for CTM-text user data if the 40 signal values originate from an AMR frame that has actually been received as unusable. This is because, owing to error concealment, the signal has few acoustic interference components, but the frequency modulated information is taken from a voice frame of the past, and hence cannot be used at the present moment in time. The demodulator (3), however, receives from the AMR channel decoder (1) the AMR-mode and RX Frame Type (in this case the BFI) information. This is used in the calculation of the reliability information, and the transmission efficiency is increased.

In the CTM receiver (6), the demodulated CTM-text bits are scanned for a synchronization sequence, which is a sequence of specific frequencies indicating that a CTM text follows. If this sequence is detected, the CTM text/voice indicator is set to the value "CTM text" and forwarded to the AMR voice decoder (2), so that the error concealment is suppressed here. At the end of the CTM-text user-data transmission, which is signaled with IDLE characters by the transmitter, the indicator is re-set to the value "voice", and the error concealment can be re-enabled.